Advanced Electronic Packaging
Advanced Electronic Packaging

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CONTENTS

Preface ................................................................................................................................. ix

Acknowledgments .............................................................................................................. xi

Materials Research Society Symposium Proceedings .................................................... xiii

JOINT SESSION:
SYSTEM IN PACKAGE

* Silicon Based System-in-Package: Breakthroughs in Miniaturization and 'Nano'-Integration Supported by Very High Quality Passives and System Level Design Tools ................................................................. 3
  Franck Murray, François LeCornec, Serge Bardy, Catherine Bunel, Jan Verhoeven, F.C.M. van den Heuvel, J.H. Klootwijk, and Fred Roozeboom

* Process and Material Requirements for Successful Heterogeneous Passive Component Integration in RF System ................................................................. 13
  Eric Beyne, Walter De Raedt, Geert Carchon, and Philippe Soussan

* Through Wafer Interconnects—A Technology Not Only for Medical Applications ...................................................................................................................... 23
  Gereon Vogtmeier, Christian Drabe, Ralf Dorscheid, Roger Steadman, and Alexander Wolter

A Patch-Type Flexible Physiological Monitor on a Non-Woven Material ................................................................. 35
  Wen-Yang Chang, Jin-Sheng Chang, Chun-Hsun Chu, Tzong-Che Ho, and Yu-Cheng Lin

An Approach for Characterizing Residual Mechanical Stress Caused by Packaging Processes ................................................................. 43
  Sören Hirsch and Bertram Schmidt

ADVANCED PACKAGING/
NANOTECHNOLOGY IN PACKAGING

Reactive Multilayer Foils for Silicon Wafer Bonding ............................................................. 51
  Xiaotun Qiu and Jiaping Wang

*Invited Paper
* Smart Lead-Free Solders via Shape-Memory Alloy Reinforcement
  Indranath Dutta, Bhaskar S. Majumdar, Tiandan Chen, Koh Choon Chung, and Bing Ye

Well-Aligned In Situ Formed Open-End Carbon Nanotube for Device and Assembly Applications
  Lingbo Zhu and Ching-Ping Wong

PHYSICAL BEHAVIOR IN PACKAGING

* Massive Spalling of Intermetallic Compound in Lead-Free Solder Joints
  Su-Chun Yang, Cheng-En Ho, Chien-Wei Chang, and C. Robert Kao

* Effect of Zn Addition on the Interfacial Reactions Between Cu and Lead-Free Solders
  Su-Chun Yang, Cheng-En Ho, Chien-Wei Chang, and C. Robert Kao

Thermodynamics and Kinetics of Oxidation of Pure Indium Solders
  Harry Schoeller, Jongman Kim, Seungbae Park, and Junghyun Cho

A Novel PPF Technique—Sn-PPF: Effects of In Situ Formation Cu-Sn-Ni Intermetallic Nano-Layer on Electronic Packaging Performances
  Lilin Liu, Ran Fu, Deming Liu, and Tongyi Zhang

MECHANICAL BEHAVIOR IN PACKAGING

* Compression Creep Behavior of the 95.5Sn-(4.3, 3.9, 3.8)Ag-(0.2, 0.6, 0.7)Cu Solders
  Paul Vianco, Jerome Rejent, Alice Kilgo, and Joseph Martin

*Invited Paper
Factors Affecting the Mechanical Properties of Cu/Electroless Ni-P/Sn-3.5Ag Solder Joints
Aditya Kumar, Zhong Chen, C.C. Wong, S.G. Mhaisalkar, and Vaidhyanathan Kripesh

Time-Lapse Measurements of Creep in Au-Sn Die Bonds
Ryan Marinis, Adam Klempner, Peter Hefli, Ryszard Pryputniewicz, Thomas Marinis, and Joseph Soucy

Mechanical Property Measurement of Interconnect Materials by Magnetostrictive Sensors
Cai Liang, Leslie Mathison, and Barton C. Prorok

ELECTROMIGRATION AND THERMAL BEHAVIOR IN PACKAGING

Electric Current Induced Brittle Failure of Eutectic Lead and Lead-Free Solder Joints with Electroless Ni-P Metallization
Aditya Kumar, Zhong Chen, C.C. Wong, S.G. Mhaisalkar, and Vaidhyanathan Kripesh

Evaluation of Void Formation Mechanism in Cu Thin Films; Separation of the Effect of Electron Wind Force and Stress
Yousuke Fujii, Masanori Tsutsumi, Junya Inoue, and Toshihiko Koseki

Thermal Management in High-Density, Stacked-Die, Multi-Chip Modules
Thomas Marinis, Dariusz Pryputniewicz, Caroline Kondoleon, and Jason Haley

Advanced Thermal Interface Materials
Yimin Zhang, Allison Xiao, and Jeff McVey

THIN FILMS AND ADHESIVES IN PACKAGING

High Performance Conductive Adhesives for Lead-Free Interconnects
Yi Li and Ching-Ping Wong
Rational Design of Highly Filled Reactive Resins for Electronic Material Applications With Multiple Performance Constraints
Daniel J. Duffy and Allison Xiao

Parylene-PDMS Bilayer Coatings for Microelectronic and MEMS Packaging
Hyungsu Lee and Junghyun Cho

Surface Flatness and Interface Stability of Ni-P Film Using New Electroless Plating Method With the Emulsion of Supercritical CO₂
Hiroki Uchiyama, Masato Sone, Chiemi Ishiyama, and Yakichi Higo

Effect of Crystallization on Adhesion Strength of External Electrode in LTCC
Minji Ko, SooHyun Lyoo, Yongseok Choi, Hyungho Kim, Hosung Choo, Beomjoon Cho, and EunTae Park

Author Index

Subject Index
Microelectronics packaging architecture evolutions are driven by silicon technology advancements; new form factors, and required used models and emerging technologies. High-performance mobile computer and communication systems will require higher I/O counts, greater density, lower cost, lighter weight and improved performance in the electronic package. Symposium V, "Advanced Electronic Packaging," held November 27–30 at the 2006 MRS Fall Meeting in Boston, Massachusetts, focused on silicon technology dimension scaling and performance improvement, Pb free or "green" assembly, and system in package (SIP) technologies. The first thrust translates into reduced silicon interconnect delay budget and the integration of the mechanically weak low-k dielectrics with flip chip and wire bond packaging. The second thrust is focused on alternative solder interconnects that are Pb-free and are typically stiffer with a higher melting temperature than eutectic Pb-based solders. SIP includes stacked 3-D thin die packaging, 2-D organic flip chip multiple-chip packaging and emerging mixed 3-D silicon-to-silicon and silicon-to-package integration with through silicon vias (TSV). In SIP, silicon can use different technologies to achieve system level function with significantly improved performance at reduced cost. Thermo-Mechanical stresses caused by these three thrusts highlight the increasing challenges to improve first level interconnects yield and reliability especially for non-hermetic organic packages that have high thermal expansion mismatch with silicon. The stress propagates from die-package first level interconnects to silicon backend process and transistor performance and reliability.

The symposium explored the key thermo-mechanical failure modes and mitigating solutions associated with integration of silicon with weak interlayer dielectrics during assembly process, under bump metallurgy integrity with lead free assembly, and the impact of stress on die cracking and transistor performance in 3-D thin die stacking. The interaction of these failures with silicon and assembly materials, processes, and design features was also covered. The MRS Symposium V Call For Papers requested original papers to cover following session topics:

- Far BE Silicon Processing
- Advanced and Nano Materials
- Interconnect Reliability
- Design-Materials Interactions
- Modeling: Thermal, Mechanical and Electrical
- Wafer Level Packaging
- Advanced Packaging Technology

- Silicon-Package Interactions
- Package Reliability
- Novel Analytical Techniques
- 3-D Interconnects
- Optical and MEMS Packaging
- System in Package (SIP)
- Pb-free Solder Interconnects

The symposium is organized into seven major sessions, based on the responses received, including System in Package, Advanced Packaging, Physical Behavior in Packaging, Mechanical Behavior in Packaging, Electromigration and Thermal Behavior in Packaging, Nanotechnology in Packaging, and Thin Films and Adhesives in Packaging. Experts in the above fields were invited to give keynote presentations in each of the sessions. The symposium had a total of 54 presentations. About 50% of the presenters submitted papers for inclusion in this symposium proceedings volume. The symposium proceedings is divided into six major sections following the order of the symposium sessions with an exception of merging the "Advanced Packaging" and "Nanotechnology in Packaging" sections into a combined section titled "Advanced Packaging/Nanotechnology in Packaging."

We hope this proceedings is of value and use for you. We appreciate your valuable feedback!!!

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Darrel Frear, Ph.D.

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ACKNOWLEDGMENTS

The symposium organizers would like to thank the MRS 2006 Fall Meeting Chairs, Dr. Babu Chalamala (Indocel Technologies, Inc.), Dr. Louis J. Terminello (Lawrence Livermore National Laboratory), and Dr. Helena Van Swygenhoven (Paul Scherrer Institute) for inviting us to organize the MRS 2006 Fall Symposium V, "Advanced Electronic Packaging," and to publish the proceedings. The support received from all of the MRS staff is very much appreciated. The organizers convey their special thanks to all presenters including invited speakers for attending the symposium and giving presentations in their area of expertise which made the symposium very useful to the attendees. The invited speakers included, in alphabetical order:

Dr. Ashish Asthana (Vice President, Intelleflex Corp.), Dr. Bill Bottoms (CEO, Third Millennium Test Solutions - 3MTS), Dr. Nikhilish Chawla (Associate Processor, Arizona State University), Dr. William Chen (Senior Advisor, ASE), Dr. Indranath Dutta (Professor, Naval Postgraduate School), Dr. Sungbo Jin (Professor, Univ. of California, San Diego), Dr. Z.L. Wang (Professor, Georgia Institute of Technology), Dr. C. Robert Kao (Professor, National Central Univ., Taiwan), Dr. Ravi Mahajan (Senior Principal Engineer, Intel Corp.), and Dr. King-Ning Tu (Professor, Univ. of California, Los Angeles). Special thanks are also extended to the authors for submitting the manuscripts for inclusion in the symposium proceedings. Last but not least, the support given by the Graduate Student Assistants: Grace Yi Li (Georgia Institute of Technology) and Ichiro Fujii (The Pennsylvania State University), etc. is very much appreciated. It was a pleasure working with the MRS 2006 Fall Symposium W ("Heterogeneous Integration of Materials for Passive Components and Smart Systems") organizers in setting up and delivering the "System in Package" joint session, and editing the manuscripts submitted to that session. The joint tutorial on Topics in Advanced Electronic Packaging—Integrated Passives, 3-D Integration, Polymers, and Integration Challenges, by the Symposium V, W, and Y organizers was very well received with an average of about 50 attendees. The support given by the Graduate Student Assistants: Grace Yi Li (Georgia Institute of Technology) and Ichiro Fujii (The Pennsylvania State University), etc. is very much appreciated. It was a pleasure working with the MRS 2006 Fall Symposium W ("Heterogeneous Integration of Materials for Passive Components and Smart Systems") organizers in setting up and delivering the "System in Package" joint session, and editing the manuscripts submitted to that session. The joint tutorial on Topics in Advanced Electronic Packaging—Integrated Passives, 3-D Integration, Polymers, and Integration Challenges, by the Symposium V, W, and Y organizers was very well received with an average of about 50 attendees. The support given by the Graduate Student Assistants: Grace Yi Li (Georgia Institute of Technology) and Ichiro Fujii (The Pennsylvania State University), etc. is very much appreciated. It was a pleasure working with the MRS 2006 Fall Symposium W ("Heterogeneous Integration of Materials for Passive Components and Smart Systems") organizers in setting up and delivering the "System in Package" joint session, and editing the manuscripts submitted to that session. The joint tutorial on Topics in Advanced Electronic Packaging—Integrated Passives, 3-D Integration, Polymers, and Integration Challenges, by the Symposium V, W, and Y organizers was very well received with an average of about 50 attendees.

MRS Fall 2006 Symposium V Graduate Student Award Winners

Special monetary awards of $400, $325, and $275 are given to three student presenters who have shown originality in their technical work, and for their overall presentations skills. The winners in the order of rank are:

First Prize ($400.00):
Student Name and Affiliation: Grace Yi Li, Materials Science and Engineering, Georgia Institute of Technology, Atlanta, GA.
Paper No. and Title: V7.1 – High Performance Conductive Adhesives for Lead-free Interconnects
Note: Grace Yi Li was a MRS 2006 Fall Meeting Graduate Student Award (GSA) finalist and a silver medal winner.
Second Prize ($325.00):
Student Name and Affiliation: Kevin Anthony Grossklaus, Materials Science and Engineering, Purdue University, West Lafayette, IN.
Paper No. and Title: V6.7 – Examination of the Melting Point of Sn Nano-Particles for Nanosolder Applications

Third Prize ($275.00):
Student Name and Affiliation: Youbo Lin, DEAS, Harvard University, Cambridge, MA.
Paper No. and Title: V4.9 – Fracture of Organosilicate Glass Coatings at Low Temperature